Isooctane-Based Anionic and Zwitterionic Surfactant: Synergistic Interaction of Mixed Reverse Micelle and Solubilisation of Erythromycin

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ABSTRACT

In the present study, the reverse micelle of anionic (sodium bis(2-ethylhexyl) sulfosuccinate) (AOT) and zwitterionic (3-*N*, *N*-Dimethyllaurylammonio propanesulfonate) (SB3–12) surfactants was mixed in an isooctane organic phase, and their behaviour towards solubilisation of erythromycin was investigated. Erythromycin is used as an alternative for gram-positive infections in patients resistant to, or allergic to penicillin for skin treatment, soft tissue infection, mycoplasma pneumonia and legionella disease. The critical micelle concentration of the mixture (CMC_{mix}) was analysed by applying phase separation and Rubingh's model of the surfactants to evaluate the synergistic effect between AOT and SB3–12 in isooctane solution. The critical micelle concentration of AOT and SB3–12 was 22.5 g/L and 0.9 g/L, respectively in isooctane phase. The critical micelle concentration of the mixed AOT/SB3–12 reverse micelle was 0.70 g/L. The mixed reverse micelle has efficiently increased the solubility of erythromycin, by which 94.2% transfer was achieved from 0.8:0.2 proportion of AOT to SB3–12. Thermodynamic parameters describing the free energy of micelle formation (ΔG_m) and standard Gibbs free energy of adsorption (ΔG_{ads}) were found to be negative which suggest that micellization and adsorption were spontaneous. The excess Gibbs free energy of mixing (ΔG^o_{ex}) value indicates that the formation of the AOT/SB3–12 mixed reverse micelle was thermodynamically stable. Conclusively, the mixed reverse micelle enhances erythromycin solubilisation in isooctane organic phase at low surfactant concentration, and the synergism of the combination between AOT and SB3–12 was positive.

Keywords: Ionic-zwitterionic; Mixed reverse micelle; Critical micelle concentration (CMC); Surfactant adsorption; Erythromycin solubilisation

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